Testbeam analysis update

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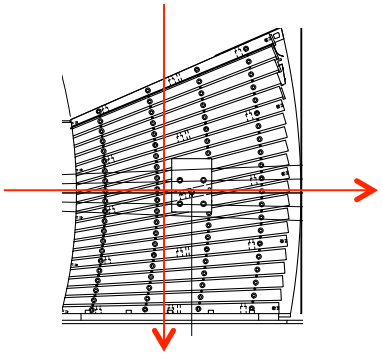
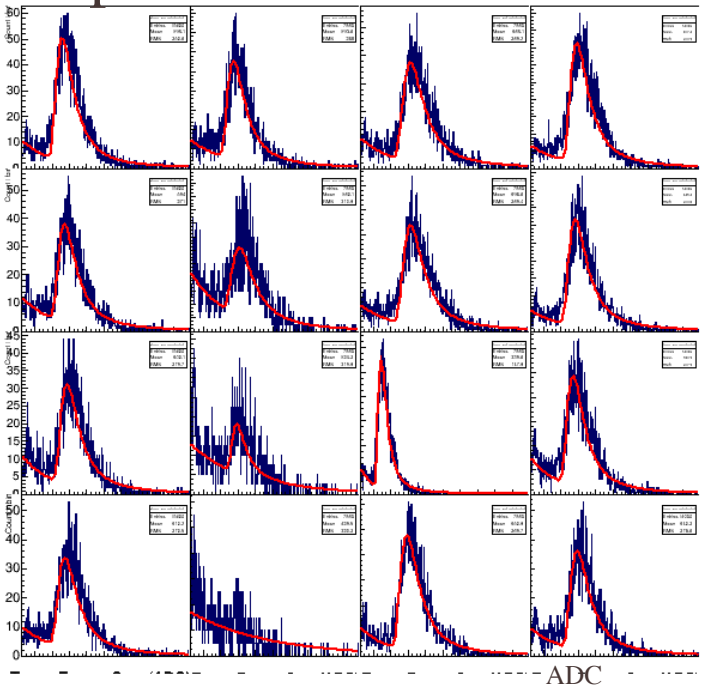
HCAL cosmic calibrations

- Action item from the testbeam workfest was a new calibration analysis, due to:
  - Updated reconstruction code.
  - Better MIP fits in data.
  - Updated cosmic simulation.



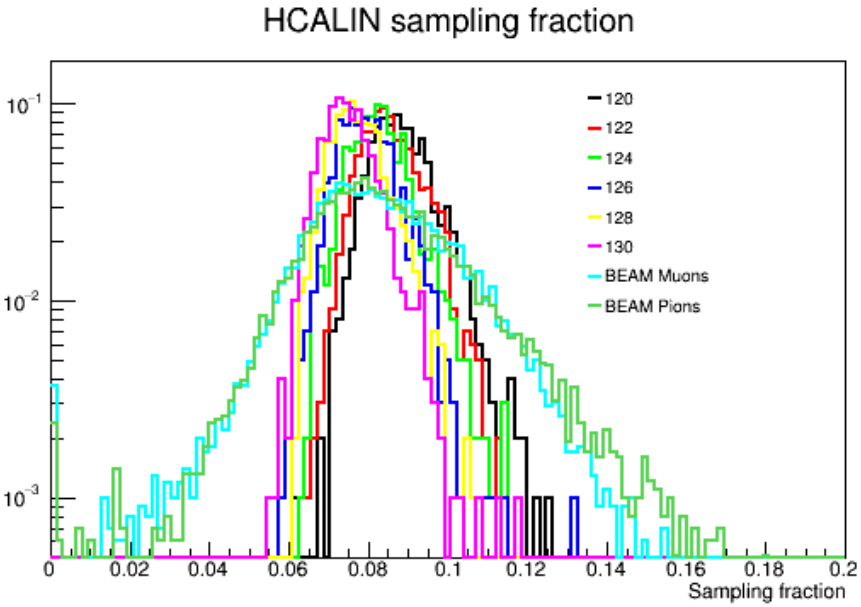
Does the geometry matter?

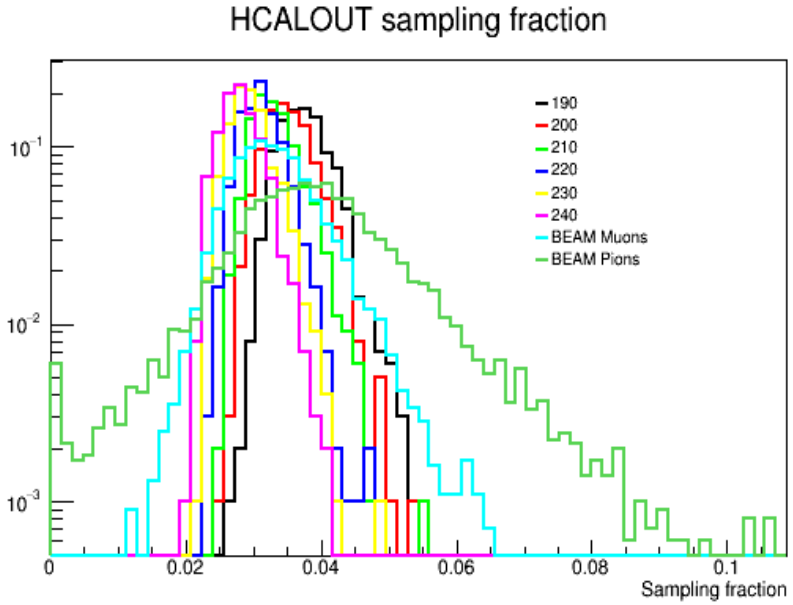
Exp + landau fit to cosmic MIPS

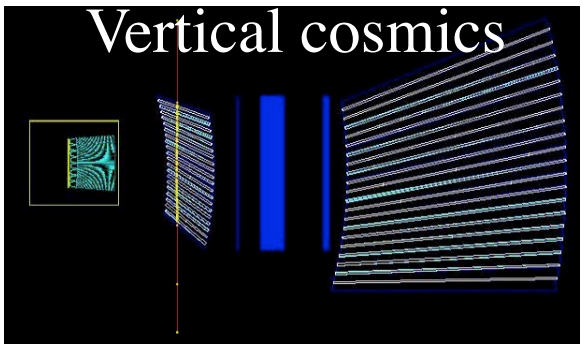


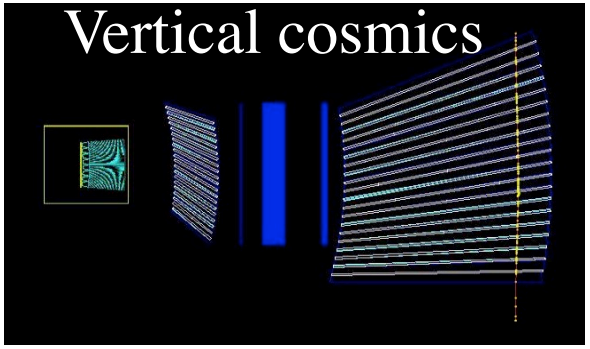
Example of Outer HCAL calibration with cosmic muons

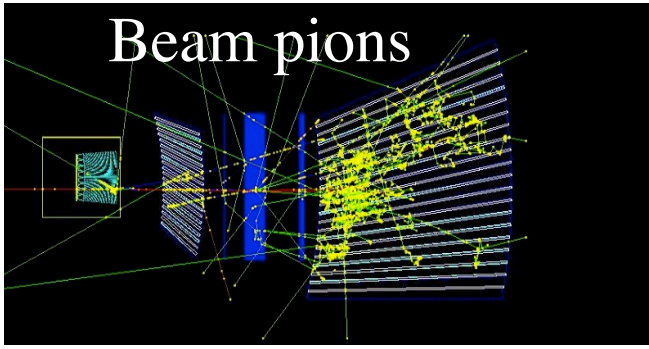
Overall comparisons







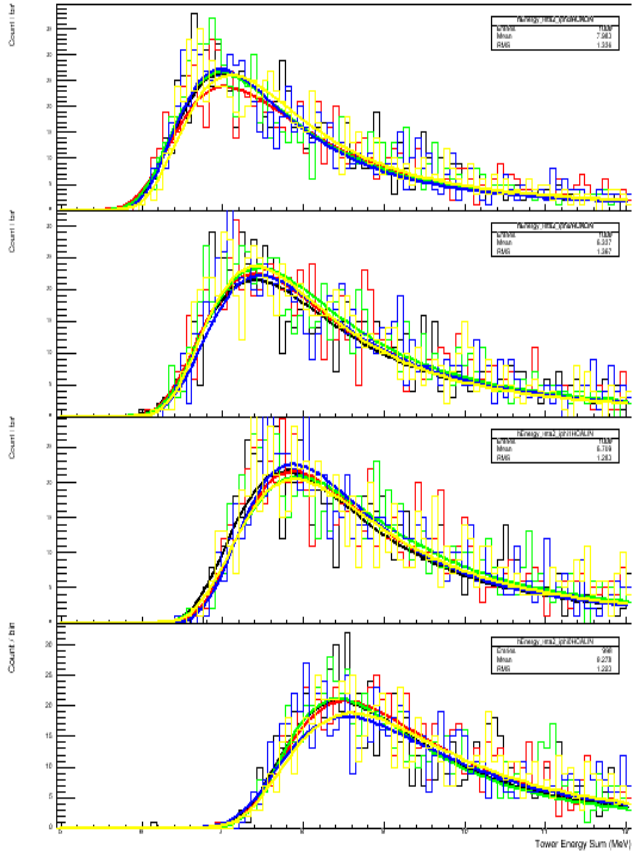




No significant change in sampling fractions.

HCALIN vertical cosmics

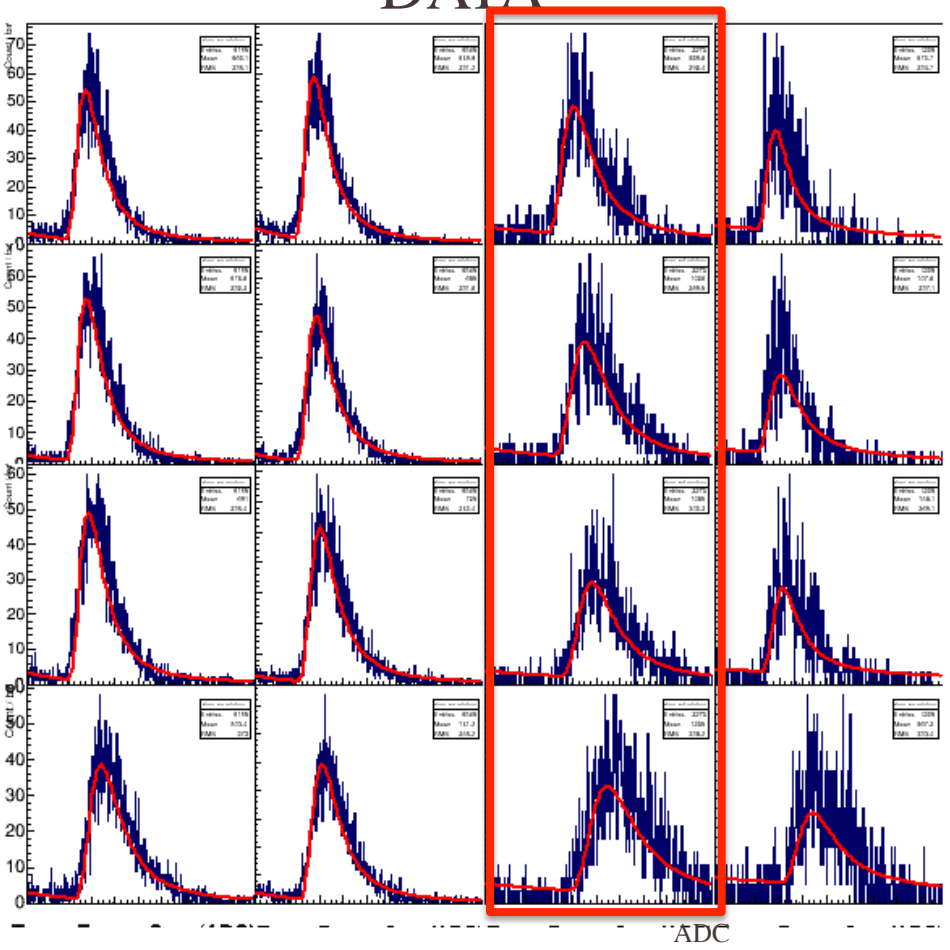
SIMULATION



Top tower

Bottom tower

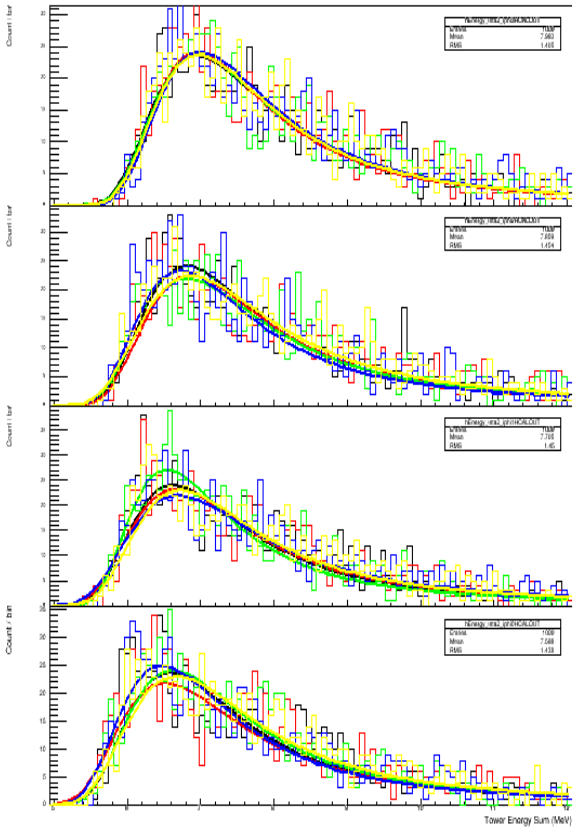
DATA



The tiles are tilted. The cosmic muon pathlength is higher for the bottom tiles.

HCALOUT vertical cosmics

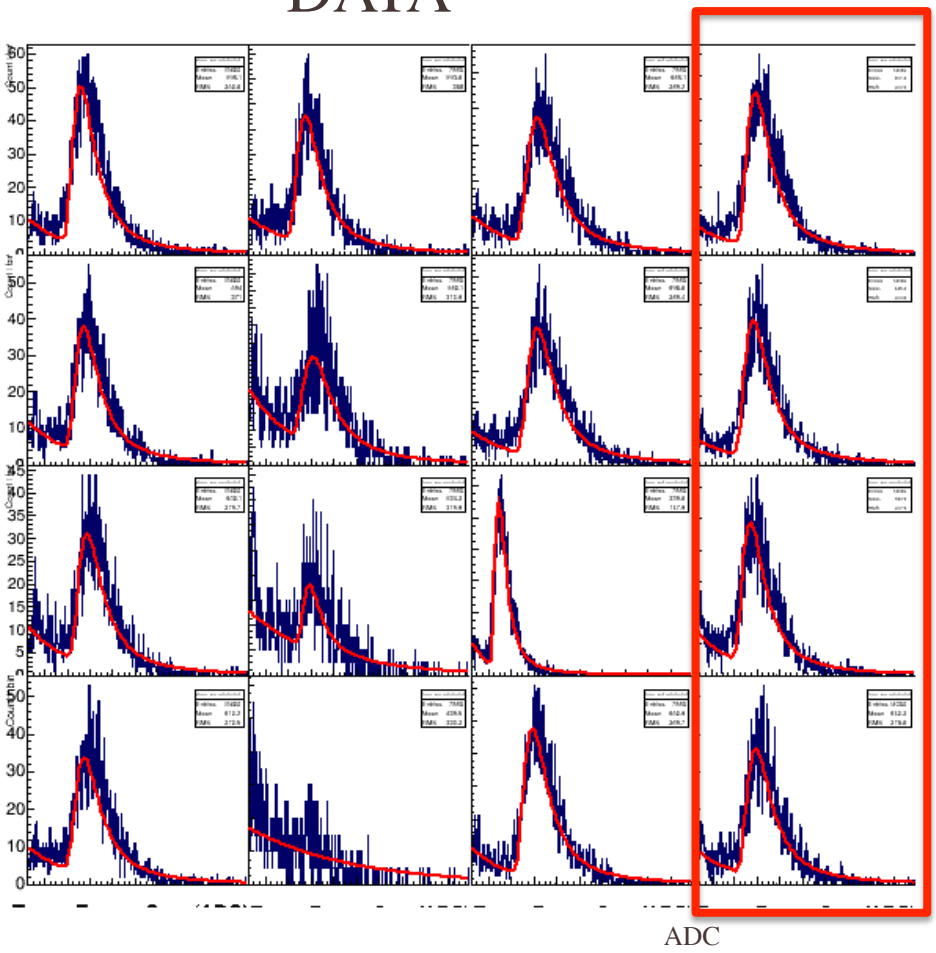
SIMULATION



Top tower

Bottom tower

DATA



The outer HCAL tiles are tilted in the opposite way.

Calibration parameters

Inner HCAL

New calibrations

0.0126626	0.0125227	0.00858584	0.0122144
0.0133382	0.0129248	0.00821871	0.0120112
0.0137416	0.0130241	0.0082034	0.0125376
0.0122607	0.0134114	0.00762492	0.00941405

Old calibrations

0.0130	0.0128	0.0086	0.0123
0.0133	0.0131	0.0083	0.0124
0.0140	0.0132	0.0083	0.0127
0.0128	0.0136	0.0078	0.0097

Outer HCAL

New calibrations

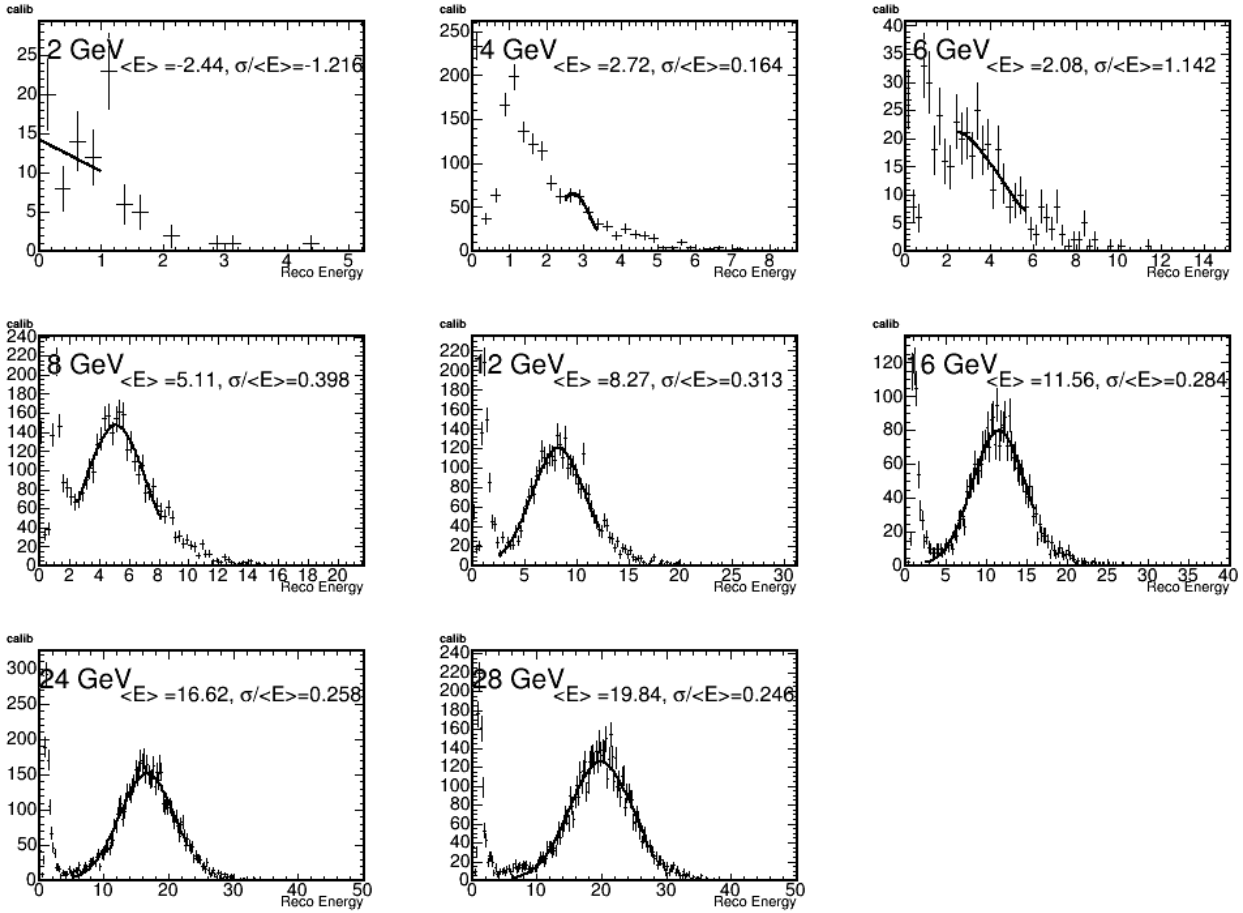
0.0133442	0.0125154	0.0109615	0.0117911
0.0124165	0.0108702	0.0107483	0.0119105
0.0112828	0.011064	0.0221987	0.0119014
0.0119416	0.00841876	0.0111577	0.0111183

Old calibrations

0.0138	0.0131	0.0114	0.0121
0.0129	0.0124	0.0110	0.0121
0.0119	0.0116	0.0196	0.0125
0.0122	NA	0.0113	0.0112

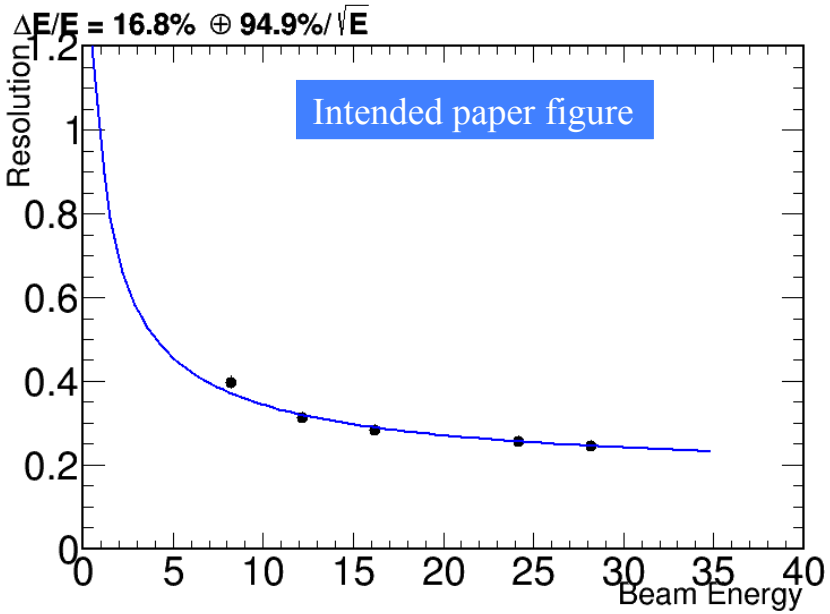
In units of GeV/HG ADC

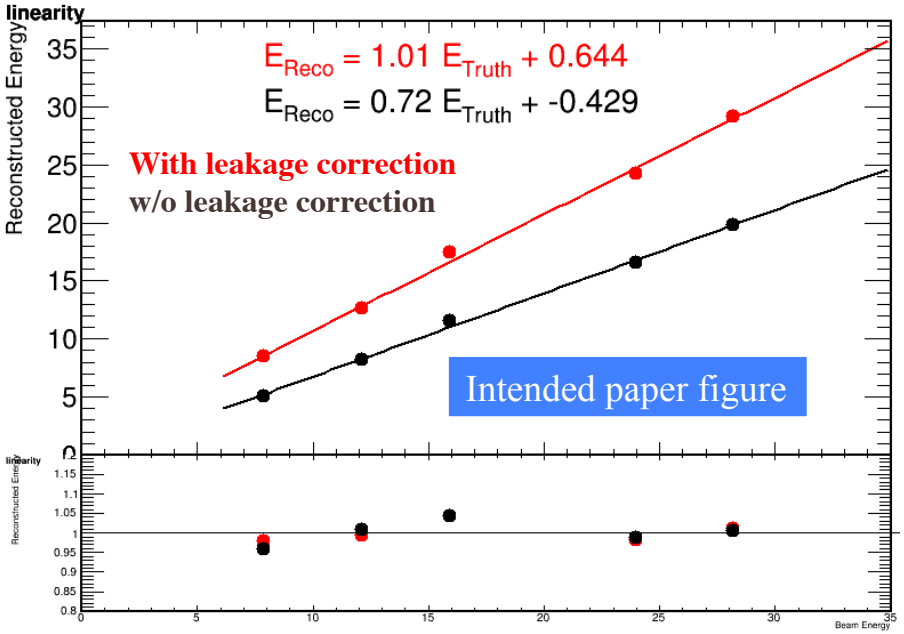
HCAL testbeam data



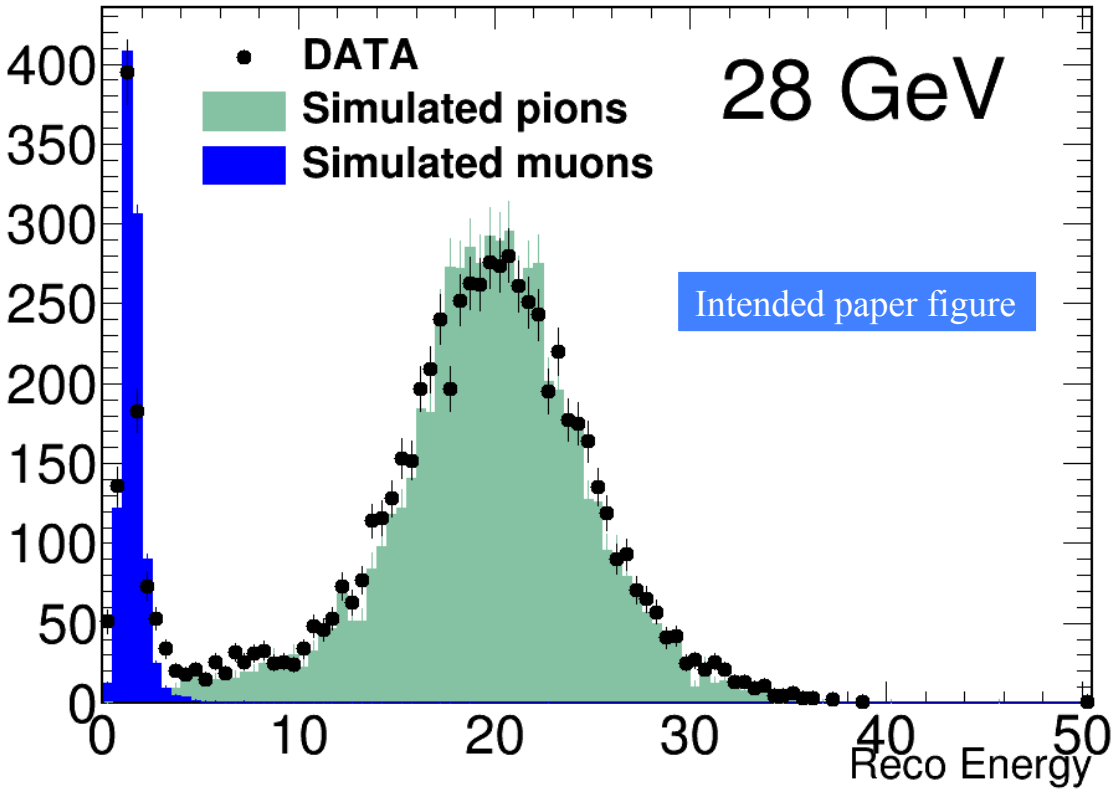
- Normal running condition including all three calorimeter segments.
- Using the EMCAL MIP events.
- Only using the cosmic mip calibrations.

HCAL Resolution & linearity





Hadron and muon components



Shower calibrations

- Shower-by-shower calibrations if running condition changed.
- What is the best possible reconstructed energy.
- Tower-to-tower calibrations: HCAL:Cosmic, EMCAL:MIPs

For EMCAL MIP events:

$$E_{reco} = p_1 E_{HCALIN} + p_2 E_{HCALOUT}$$

$$p \equiv Min \sum_{i=0}^{N_{events}} (E_{reco} - E_{truth})^2$$

After shower calibration